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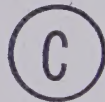
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OBJECT POSSESSION AND OBJECT PERMANENCE:
A COMPARISON OF THE WORKS OF JEROME BRUNER AND JEAN PIAGET
CONCERNING COGNITIVE DEVELOPMENT IN INFANTS

by



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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "Object Possession and Object Permanence: A Comparison of the Works of Jerome Bruner and Jean Piaget Concerning Cognitive Development in Infants" submitted by Dexter Roland Amend in partial fulfilment of the requirements for the degree of Master of Science.

Abstract

2 tasks were administered to a group of infants aged 4-20.5 mns.. The first task, adapted from Bruner and Lyons (1969), indicated cognitive development in terms of the exhibition of particular skills required to take possession of several objects at a time. The second task, adapted from Decarie (1965), indicated cognitive development according to the stages of object permanence proposed by Piaget (1952, 1954). The sequential emergence of skills in the first task, and of stages in the second task were evaluated. Performance on both tasks indicated that the skills, and the stages, occur in an invariant sequence. Bruner's step like process of development was supported, and Piaget's stage hypothesis was confirmed. The relationship between the ability to store objects and the acquisition of object permanence was examined. Subjects who did not store objects had not acquired object permanence. Subjects who routinely stored objects had acquired the concept of object permanence. Evidently, the ability to store objects is a necessary precondition for acquisition of object permanence.

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Table of Contents

	Page
Abstract.....	iii
Acknowledgements.....	iv
Table of Contents.....	v
List of Tables.....	vii
List of Figures.....	viii
Introduction.....	1
Piaget and Object Permanence.....	2
Stage III.....	3
Stage IV.....	3
Stage V.....	4
Stage VI.....	5
Bruner and Object Possession.....	6
The first object.....	9
The second object.....	9
The third object.....	10
The fourth object.....	11
Storing Objects and Object Permanence.....	13
The Present Experiment.....	14
Method.....	16
Subjects.....	16
The Object Permanence Task.....	16
Materials.....	18
Task Items.....	19
The Object Possession Task.....	24
Materials.....	24

Table of Contents (continued):

	Page
Task Performances.....	25
Procedure.....	27
Results.....	29
Bruner's Skills.....	29
Piaget's Stages, and Items of the 'Piaget Series'.....	32
The Relationship Between Bruner's Skills and Piaget's Stages.....	35
Discussion.....	40
The Materials.....	40
Administration of the Tasks.....	42
Bruner's Skills.....	43
Piaget's Stages, and the Items of the 'Piaget Series'.....	46
Object Possession and Object Permanence.....	47
Conclusion and Suggestions for Further Study...	50
References.....	52
Appendix.....	54

List of Tables

	Page
Table 1 The Relationships Between Bruner's Four Skills.....	31
Table 2 The Relationships Between Piaget's Four Stages.....	33
Table 3 The Relationships Between the Items of the 'Piaget Series'.....	34
Table 4 Bruner's Sequence of Skills and Piaget's Sequence of Stages.....	36
Table 5 The Relationships Between Bruner's Skills and Piaget's Stages.....	37

List of Figures

Page

Figure 1 Schematic of the Apparatus.....	20
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Introduction

Jean Piaget, presently the recognized authority in the field of infant cognitive development (White, 1971), published in French, in 1936 and 1937, a theory of sensorimotor intelligence which postulates a sequence of stages marking intellectual growth from birth to approximately 18 months of age (Piaget, 1952, 1954). The last four stages of Piaget's sensorimotor period cover the age range 4 to 16-20 months and pertain specifically to the development of the concept of object permanence.

Jerome Bruner, who became prominent in the field of cognitive psychology through his work with adults (Bruner, Goodnow & Austin, 1956) and through his work with older children (Bruner, Olver & Greenfield, 1966) recently began studying cognitive development in infants (Bruner, 1969a). When investigating the ability of infants (aged 4 to 18 mns.) to take possession of objects, Bruner observed what he believed to be a step like process of skill acquisition (Bruner & Lyons, 1969).

In the present study the step like process of skill acquisition reported by Bruner, and the sequence of stages proposed by Piaget were examined with the general purpose to find out what relationship there may be between infants' ability to take possession of objects, and their recognition that objects have permanent, independent existence.

Presented below is a review of infant cognitive development in terms of Piaget's object permanence and Bruner's object possession. A setting is provided which serves to distinguish the particular questions this research was designed to answer.

Piaget and Object Permanence

In 1929, Piaget began studying the development of object permanence in his own children. Piaget carried out game-like investigations in which he would hide pencils, rattles or other objects in his hand, under a blanket or a beret, to see if his children could find them. He carefully observed and recorded in detail the behavior of his children in these game-like situations (Elkind, 1969). Piaget observed that infants act as though they do not recognize the permanent existence of objects. Piaget's children seemed to consider objects only in relation to their own behavior--as though objects were extensions of their own sensorimotor activity and not independent of it. Piaget's work with his children soon led to his theory of sensorimotor intelligence, in which he described six sequential stages. The first two stages of the sensorimotor period, which cover approximately the age range 0-4 months, do not specifically pertain to the development of object permanence. Infants of this age do not respond at all to an object which disappears (Piaget, 1954, pp. 4-13). The

last four stages which pertain specifically to the development of object permanence reflect the gradual growth of the separation between the infant and the objects of his activity.

Stage III. During the third stage which covers approximately the age range 4-9 months, an infant will visually follow an object which disappears from view. He will also reach for a visible object and prolong his reach to get the object, so long as the object is not completely hidden from view. But if the object disappears completely (under a cover or behind a screen), the infant will terminate his reach and make no further attempt to find the hidden object. The 'search' the child makes during the third stage is only a continuation of the behavior he was emitting while the object was present (Piaget, 1954, p. 4).

Stage IV. During the fourth stage, which covers approximately the age range 8-10 months, an infant will prolong a reach initiated while the object was in view, and continue his search for the object even after it has been completely hidden. He will also search for and find an object which has been completely hidden prior to his reaching for it. But an infant is unable to take into account visible displacement of an object. For example: if at first an object is completely hidden under cover a, the infant will search for and find it. If next the object is made to disappear under cover a, but is then moved under cover b while the infant is watching, despite the visible

displacement of the object from a to b, the infant invariably searches under a where he found the object at first. The search the infant makes during the fourth stage is initiated after the object is hidden. It is no longer just a continuation of an on-going response. Yet, the object is still intimately tied to the infants activity as indicated by his inability to take into account the change in position of the object. The object is just an extension of his reach response (Piaget, 1954, pp. 59-66).

Stage V. During the fifth stage, which covers approximately the age range 12-18 months, an infant now can take into account visible displacement of an object. If the object is first hidden under cover a and then moved to b, the infant will go directly to b and find the object. An infant is also able to find an object which is 'invisibly hidden'. For example: if an object is first placed out of sight within a container (box, or cup, etc.) which is then moved behind a cover where the object inside is deposited, when given the empty container, the infant will look inside for the object and then go directly to the cover and find it. But an infant is unable to take into account invisible displacement of an object. For example: if an object is first placed out of sight within a container and moved under cover a, then, as the container is moved from a to b allowing the infant to see the object within, when the object is deposited under b and the empty container given

the infant, he may or may not look in the container, and he will 'grobe' between the two covers eventually finding the object, or not. In any case, the infant does not systematically search by examining the container and going directly to cover b where the object was deposited. So, although the infant can find an object which has been 'invisibly hidden', and though he can account for the displacement of an object, he is unable to find an object which is both 'invisibly hidden' and displaced. The search the infant makes during the fifth stage reflects a more definite dissociation between his activity and the object. For the infant, the object has immediate practical substance, so long as he sees its displacement, or so long as the object does not undergo a change in position (Piaget, 1954, pp. 67-73). Yet, the 'groping' of the stage V infant reveals his uncertainty respecting objects invisibly displaced, and reflects the fact that the existence of the object for the infant is still dependent on the practical context of his immediate activity. The object does not yet have permanent, independent existence for him (Piaget, 1954, pp. 77-78).

Stage VI. During the sixth and final stage, which covers approximately the age range 16-20 months, an infant can account for invisible displacement of an object. In terms of the previous example, he will examine the container and without groping go directly to cover b to

find the object. Finally, the infant is able to account for a sequence of invisible displacements. In this case, an object is 'invisibly hidden' and then moved under three covers after the manner described in the previous example. But, the cover under which the object is deposited (either a, b or c) varies over several presentations. With each presentation, the infant examines the container for the object, then without 'groping', goes directly to the last cover from which the container was brought, to find the object. The search the infant makes during the sixth stage indicates that the infant recognizes that an object retains its permanence independent of changes in its position, and independent of his visual perception (Piaget, 1954, pp. 78-86). The infant would be unable to find an object invisibly displaced if he did not have a mental representation of it (Piaget, 1954, p. 93). For this reason, the last stage of the development of object permanence heralds the beginnings of imaginal thought for the infant. The image of the object is an invariant representation which the infant has and maintains, independent of the objects disappearance and change in position (Piaget, 1954, pp. 93-96).

Bruner and Object Possession

In 1967, Bruner began studying questions similar to those just discussed. He and his collaborators at Harvard carried out a series of studies covering a range of infant

behavior from neonatal sucking and visual perception, to the manipulation of objects in older infants (Bruner, 1969b). Bruner's studies convinced him that the behavior of infants--although rigid, awkward, and often ineffective--nevertheless expresses the intention of infants to achieve goals (Bruner & Lyons, 1969, p. 16). Bruner reasoned that infant cognitive growth, just as learning in adults, may be appropriately characterized in terms of acquiring skills, or developing the ability to solve problems.

"The typical problem solving of the infant has to do with the use of hands, of eyes, of bodily orientation, etc., in dealing with things and people. At first glance, these seem exclusively like matters of perception, of attention, of manipulation and locomotion, of social interaction--and their maturation and development. But it is precisely in the use and coordination of these processes for the attainment of goals that we encounter the earliest problem solving. When such problems are solved, we properly speak of the child as having achieved a skill (Bruner, 1969b, p. 1)."

In the study to be discussed below, a task was administered which required infants to take possession of an increasing number of objects. The question was: how many objects can an infant take and keep and, more important what skills must an infant have or acquire in order to take and keep several objects at a time?

Bruner and Lyons (1969) studied 49 infants (aged 4-18 mns.) divided into 5 groups: 4-5 mns., 6-8 mns., 9-11 mns., 12-14 mns., and 15-17 mns.. Bruner and Lyons summarized

their methods as follows:

"A small toy is handed to the right or left hand. When it is taken, a second toy is immediately presented on the side of the full hand. If not taken after 15 or 20 seconds, the second toy is shifted to the midline. A third and then a fourth object is presented at the midline if the child has taken and retained preceding objects handed to him. When at any point in the four presentations, the child indicates clearly that he will not take the next object, the trial is ended. Each infant at each age had his four trials divided such that half would be done initially with the left hand and half with the right (Bruner & Lyons, 1969, p. 4)."

Results indicated that older infants were able to take possession of more objects (Bruner, 1969b, fig. 4). It also was discovered that performance of the task depended on the development of a sequence of skills or problem solving strategies which were characterized by a "striking series of steps upward at each age", (Bruner, 1969b, p. 17 and fig. 7). The specific sequence of skills displayed by the infants when performing the task included: (a) the ability to reach and grasp a single object; (b) the ability to shift an object from one hand to the other, to free a hand to take a second object; (c) the ability to deposit an object at some depot point (e.g., in the lap, in the crook of the arm, or elsewhere) to empty a hand to take a third object; (d) the ability to leave a deposited object in storage in order to take more objects. The following synopsis of Bruner's observations and findings indicates how Bruner characterizes

the development of this sequence of skills. The material is organized in terms of the infants' responses to the presentation of each successive object.

The first object. All infants, but two in the youngest group (age 4-5 mns.) were able to reach and grasp a first presented object (Bruner & Lyons, 1969, tbl. 1, p. 6). These two, although intensely attracted to the object (as indicated by raising of the arms and an increase in 'mouthing activity') were unable to direct and coordinate arm-reaching with hand-grasping in order to capture the object (Bruner & Lyons, 1969, p. 5). Several others in the youngest group, although they were able to reach and grasp the object, were unable to maintain control of it for more than a few moments (Bruner & Lyons, 1969, p. 5). Most infants in the youngest group who captured the first object, brought it immediately to their mouths (Bruner, 1969, p. 14, fig. 3).

The second object. Taking possession of two objects requires maintaining control of the first, while taking the second. Whereas less than half of the youngest group were able, on their best trial, to take possession of the second object, all infants in the next group (age 6-8 mns.) were able to do so (Bruner & Lyons, tbl. 1, p. 6). The procedure (cited earlier) calls for the second object to be initially presented to the hand which holds the first. This requires the infant to shift the first object to the opposite hand,

if he is to possess the second. (It should be noted that according to observations Bruner made prior to this study, infants younger than 1 yr. of age will not reach across the midline, Bruner & Lyons, 1969, p. 9). Most infants in the first two groups (age 4-8 mns.) were unable to cope with this requirement by shifting the first object to the opposite hand (Bruner & Lyons, tbl. 4, p. 9). Instead, they took the second object only after it was presented at the midline.

The third object. Taking possession of three objects requires maintenance of the first two. It also requires that one hand be emptied in order to take the third object. None of the infants in the youngest groups (age 4-8 mns.) were able to cope with these requirements (Bruner & Lyons, 1969, tbl. 6, p. 11). Instead, infants in these groups either abandoned (dropped) one or both of the two objects they had previously taken, to possess the third (Bruner, 1969, p. 15), or they reached for the third object with hands filled, hitting it with the objects in their hands (Bruner & Lyons, 1969, p. 10). Here, it must be mentioned that Bruner had the toys (objects) made large enough so that only one toy could fit in each hand of the younger infants (Bruner & Lyons, 1969, p. 8). However, the oldest infants were able to take more than one toy in each hand, (Bruner & Lyons, 1969, p. 12). In the next two groups (age 9-14 mns.), more than half of the infants were able, on

their best trial to respond to the requirements of the task by depositing one of the objects already possessed (Bruner & Lyons, 1969, tbl. 6, p. 11). But, less than half of these infants were able to leave a deposited object in storage in order to take the third object being presented (Bruner & Lyons, 1969, tbl. 6, p. 11). Instead, they retrieved the deposited object immediately, often making no further attempts to take the new object which initially prompted their deposit response (Bruner & Lyons, 1969, p. 10).

The fourth object. Taking possession of four objects requires maintaining possession of three, while taking the fourth. To respond appropriately to this requirement, the infants must have deposited the second and third objects previously presented, and left them in storage. Seven infants of ten in the oldest group (age 15-17 mns.) were able on their best trial to store objects (Bruner & Lyons, 1969, tbl. 6, p. 11). The three infants in the oldest group who did not store objects through deposit, took possession of four objects nevertheless because their hands were large enough to hold more than one object (Bruner & Lyons, 1969, p. 12).

The notion of task requirement obviously is important in Bruner's "skill" or "problem solving" description of infant cognitive development. According to Bruner, performance of a skill depends upon: (a) comprehension of the requirements of a task; and (b) construction of a

response appropriate to the task requirements (Bruner, 1969, p. 5). Application of this scheme becomes particularly confusing in the case of the response of the infants aged 9-14 months, to presentation of the third object. Here it will be recalled that while most infants were able to perform the response necessary for taking possession of a third object (they performed deposit--the response required to empty a hand in order to take the third object) many did not follow through to take possession of it. Bruner explains this finding as follows:

"Indeed, half of the deposited toys were retrieved after being deposited in a storage place, as we have already noted. Often, in fact, a child became so engrossed in repeating the routine of deposit and retrieval that he ignored a new toy being offered. Pleasure in performing the new skill obviously interfered with performance of the task as defined by the experimenter.

We gained the strong impression that the act of storage involved several important but conflicting components. One was a form of detour activity that involved putting down an object in order to have more objects--somewhat akin to turning one's back on an object that one wants in order to get it via a detour. There was plainly a good deal of conflict involved in this activity that needed resolution before storage could become easy and modular. A second element of conflict is provided by the requirement of leaving an object in storage. Once out of hand, a toy placed in the lap becomes a new temptation. Before it can be left there, there must be the inhibition necessary for delay of gratification (Bruner & Lyons, 1969, p. 16)."

Storing Objects and Object Permanence

Bruner's findings concerning deposit and storage which he explains in terms of conflicts with the task requirements might also be the result of the infants' incomplete development of object permanence. As previously discussed, during most of infancy objects exist only in the context of immediate sensorimotor activity. The above quote from Bruner suggests that when an infant deposits an object (i.e., relinquishes it from his sensorimotor activity)--"turns his back on it" as it were--the object ceases to exist for him. Consequently, the infant "retrieves" the object (i.e., reincorporates the object into the context of his immediate sensorimotor activity).

If the deposit-storage conflicts described by Bruner are in fact the result of incomplete development of object permanence, then it might be surmized that infants who exhibit no conflict when storing objects have acquired the concept of object permanence. The ability to store objects which requires the infant to deposit an object and leave it in a place removed from his immediate sensorimotor activity may indicate that the infant has developed the concept of object permanence (i.e., he has acquired a mental image of the object, or a central process which internally represents the object independent of his sensorimotor activity).

Unfortunately, the results of the Bruner and Lyons

study obscure a possible relationship between storing objects and object permanence. Although findings concerning reach and grasp, and hand to hand shift were reported in terms of frequency over four trials to indicate how these skills become well modularized and routine in older infants, data concerning deposit and storage were reported in terms of whether these skills were exhibited on the best trial, or not. The results gave no indication of how frequently or routinely these later skills were deployed by the older infants. In so far as object permanence may be indicated by the resolution of the deposit-storage conflict (as previously suggested), exhibition of storage at least once in four trials does not clearly indicate the absence of conflict. Infants who stored on their best trial may have deposited and retrieved on the other trials--indicating that conflict was not resolved. Further, the fact that older infants were able to take more than one object in each hand, and thus circumvent the conflict incurred by infants with smaller hands who had to deposit, confounds a possible relationship between storing objects and object permanence.

The Present Experiment

Support for a step wise process of development is indicated when it can be shown that a set of acquisitions occurs in a fixed sequence (Pinard & Laurendeau, 1969).

Although the results of the Bruner and Lyons study suggested a step like process of development, they did not clearly specify that the skills previously listed were invariably exhibited in sequence. Whereas Piaget's sequence of stages has been largely confirmed by subsequent research (e.g., Decarie, 1965; Uzgiris & Hunt, 1966; Escalona & Corman, 1967), no research (prior to the present study) has subsequently evaluated Bruner's skills.

The first purpose of the present experiment was to test the invariant sequence of Bruner's skills, and Piaget's stages on a common sample of subjects. An object possession task was given according to the method described by Bruner (cited previously). But, the objects used in the present task were such that no infant could take more than one object in each hand. An object permanence task was given adapted largely from Decarie (1965).

The second purpose of the present experiment was to examine the relationship between storing objects and object permanence. In this regard the following hypotheses were proposed:

1. Infants who deposit but do not store, have not acquired the concept of object permanence.
2. Infants who routinely store objects, have acquired the concept of object permanence.

Method

Subjects

The sample consisted of 40 infants, 17 males and 23 females, aged 4-20.5 months. 19 of the infants were children of students living in the area of the University of Alberta. 21 of the infants were obtained from day care centers in the city of Edmonton. All subjects had normal births, and were in good health when the tasks were given. All subjects tested, but one, were included in the sample. The experimenter was not able to obtain the birth date of one boy tested in a day care center, and so another subject was substituted.

The Object Permanence Task

The object permanence task used in this experiment was adapted from Decarie (1965). Decarie's 'Piaget Series', which includes eight items (two for each stage of object permanence) represents the first attempt to systematize in the form of a test the many observations reported by Piaget in his early writings. Since publication of the 'Piaget Series', Uzgiris and Hunt (1966) and Escalona and Corman (1967) have also developed measures of object permanence. Escalona and Corman have more recently published results which validate the sequence of tasks they use (Corman & Escalona, 1969). A replication of the Uzgiris and Hunt

measure has also been performed recently which largely validates their results, but suggests some important methodological changes (Miller, Cohen, Hill, 1970).

The Uzgiris and Hunt, and Escalona and Corman tests, consist respectively of 16 and 18 items. Both tests require all sorts of equipment. Each takes quite a long time to administer--often more than a day in the case of Escalona and Corman. And, each test requires a good deal of familiarity and practice for proper administration. The 'Piaget Series', on the other hand, is relatively short. The necessary equipment is comparatively minimal. And, the test does not require as much time or experience to administer properly.

Miller, Cohen, and Hill (1970) point out that the excessive amount of time required to administer the 16 item test of Uzgiris and Hunt likely allows such factors as fatigue, boredom, and frustration to occur, particularly in the younger infants who have more difficulty with the earlier tasks. Their results show that no difference in mean performance occurred, for example, among tasks 4-7 and 11-14. They suggest therefore, that only one task from each stage should be used when measuring object permanence, in order that the complete set of tasks given may remain within the infants' fatigue and attention limitations.

The 'Piaget Series' was best suited to the present investigation because this study did not require the more

resolute definition offered by the other two measures. Moreover, the 'Piaget Series' obviates the attention problems pointed out above, and conforms to some extent with the suggestion of Miller, Cohen and Hill, since it incorporates only two items for each object permanence stage.

An important methodological change in the Miller, Cohen, and Hill study, is the use of identical covers to avoid individual preferences for color, shape and texture. In each of the tests, including the 'Piaget Series' as administered by Decarie, covers of different sorts (such as pillows, placemats, potholders, pans, etc.) are used more or less at random. Procedure for administration is also variable, and may be downright impromptu, as evidenced in the 'General Directions' of Escalona and Corman (1967). The apparatus described below was designed to eliminate possible individual preference for covers; but, also to operationalize as completely as possible the procedure for administration.

Materials. The apparatus consisted of a board (stage) 30 inches long and 6 inches wide with 6 equidistant holes drilled into the leading edge, and 3 curtains (screens or covers). Each curtain was made from two pieces of black plastic garbage bag, (this material can stand a good deal of manipulation, and is finally, easily replaceable) hung from a brass rod supported by two $\frac{1}{2}$ inch dowels, 6 inches

in length. From one to three curtains may be placed into the holes of the board, providing as many screens and as many positions as are necessary for administering all items of the 'Piaget Series' (Figure 1, below).

For the invisible displacements, a 12 ounce vegetable can was used. The label (corn) was left on the can to maintain a more 'ordinary' appearance. The same four objects were used for all subjects: (a) a black and white rubber cow; (b) a green 'hot wheels' car; (c) a small furry felt animal, with little seed nose; and (d) a plastic thing (the best object).

Pilot work with several infants of various ages within the range covered by this study, was undertaken to determine the general efficacy of these materials. The apparatus proved workable, and the objects sufficiently stimulating. Pilot work revealed an almost universal and magnetic attraction for the fourth object listed above. For this reason, during the present investigation, although the first three objects were presented randomly and occasionally changed to promote maximal attention, the 'plastic thing' was usually saved by the experimenter as an 'Ace in the Hole', to be used only after the other objects had 'lost their charm'.

Task items. The task items as written below, reflect to some extent Bell's (1968) adaptation of Decarie's 'Piaget Series'. These items were also altered to conform

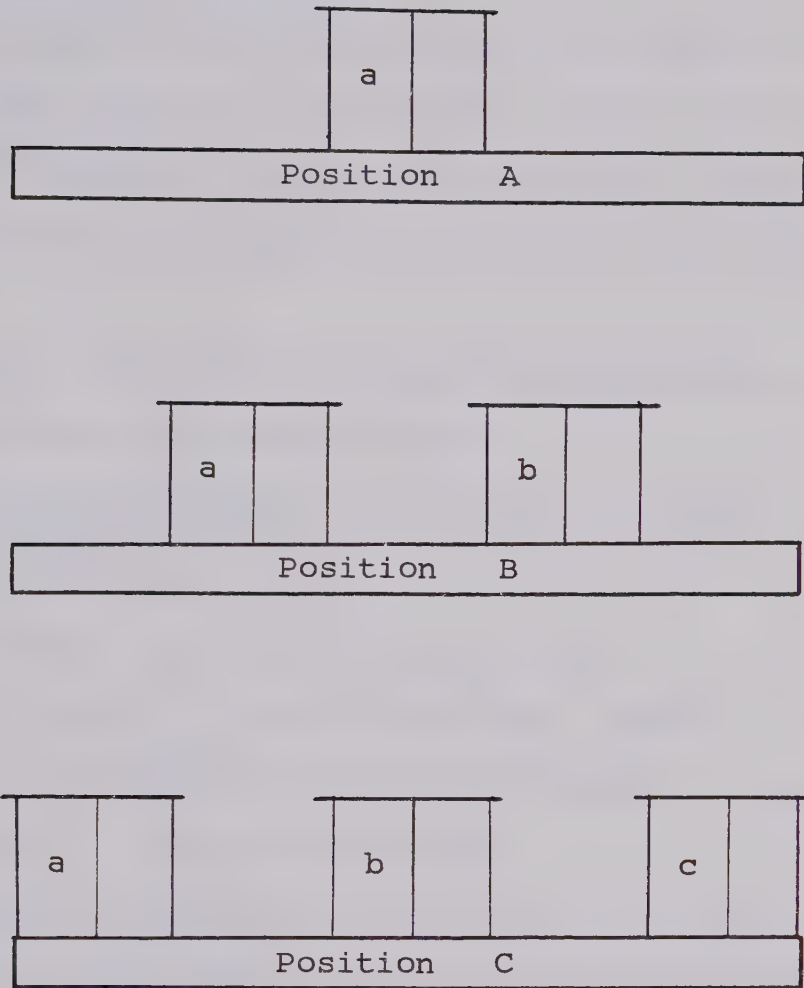


Figure 1. Schematic of the apparatus.

to the specifications of the apparatus described above.

Item 1 Visual accomodation

The subject's (S's) attention is attracted to the object. The experimenter (E) slowly lowers the object before S, letting it drop to one side of S's visual field. The presentation is repeated once to the right and once to the left.

The item is passed if S immediately searches for the object at least once where it fell.

Item 2 Reconstruction of a whole from a visible part
(curtain position A)

E presents the object for S to grasp. As S reaches to grasp, the object is placed behind the curtain. The curtain is immediately pulled back (separated) making visible to S, a part of the object.

The item is passed if S separates the curtain to reveal the entire object and/or if he takes the object from behind the curtain.

Item 3 Active search with grasping move
(curtain position A)

E presents the object for S to grasp. As S reaches to grasp, the object is hidden completely behind the curtain.

The item is passed if S continues his reach and finds the object.

Item 4 Without sequence of visible displacements

(curtain position A)

S's attention is attracted to the object which is immediately hidden completely behind the curtain, before S begins his reach.

The item is passed if S searches for and finds the object.

Item 5 With sequence of visible displacements

(curtain position B)

The object is placed behind curtain a, and S is allowed to find it there. After 2 presentations behind a, the object is placed behind b.

The item is passed if S searches for and finds the object behind b, without first going to a.

Item 6 Without sequence of invisible displacements

(curtain position A)

While S is watching, the object is placed out of sight inside the can. E moves the can behind the curtain, where he deposits the object. The empty can is brought out, and placed upside down before S. E asks, 'where is the object?'.

The item is passed if S looks inside the can, and then searches for and finds the object.

Item 7 With sequence of invisible displacements

(curtain position B)

While S is watching, the object is placed out of sight inside the can. The can is moved behind a, and then from a to behind b, in a slow continuous motion. In the open interval between curtains a and b, E tilts the can, revealing the object inside, saying, 'look, here is the object'. The object is deposited behind b, and the empty can is brought out, and placed upside down before S. E asks, 'where is the object?'. Alternations ab and ba are administered.

The item is passed if S searches directly in the last place on both trials, and finds the object.

Item 8 Systematic use of representation

(curtain position C)

While S is watching, the object is placed out of sight inside the can. In a slow continuous motion, E moves the can behind a, behind b and behind c. In the open intervals a-b and b-c, E tilts the can revealing the object inside, saying, 'look, here is the object'. The object is deposited behind c, and the empty can is brought out, and placed upside down before S. E asks, 'where is the object?'. E repeats this item 3 times, leaving the object in each case behind the last curtain, in the sequence:

1. abc
2. cba
3. acb

Items 1 and 2 represent the first stage of object

permanence (extension of accommodation), which corresponds to stage III of Piaget's sensorimotor period. Items 3 and 4 represent active search, which corresponds to stage IV. Items 5 and 6 represent visible displacements which corresponds to stage V. Items 7 and 8 represent invisible displacements which corresponds to stage VI--the last stage of the sensorimotor period, and the last stage in the development of object permanence. The items of the 'Piaget Series' have similar counterparts in both Uzgiris and Hunt and the Escalona and Corman measures. For a discussion of how items from all three measures compare, see Bell (1968).

The Object Possession Task

The object possession task consisted in the presentation of four objects to the infants according to the procedure of Bruner and Lyons, cited in the introduction. But, the objects used in this experiment were such that no infant could hold more than one in each hand.

Materials. The objects used in this task were balls fashioned from aluminum foil. Aluminum foil balls had proved to be an attractive stimulus object for infants, in studies carried out by Uzgiris when she was preparing her object permanence scale (Uzgiris, 1970). These objects proved to be particularly good for object possession. Although they are approximately spherical, they are not

uniformly round or slippery like a ball, which makes them easy to grasp. Such objects are also easy to hold because they are not heavy or cumbersome. More importantly however, aluminum foil enables the construction of 'identical' objects, but of different sizes. In order to account for differences in hand size among the infants, and, in order to insure that only one object could be taken per hand by all infants, three sets of four objects were made. The first set was fashioned from four sheets of heavy gauge aluminum foil (shiny side out) sized 9"x6". The circumference of the balls in this set was approximately 4". The second set was made from sheets sized 9"x9", with a circumference approximately 5". The third set was made from sheets sized 9"x12", with a circumference approximately 6". One further virtue of aluminum foil balls should be noted. These objects, which often find their way to the mouth, are easily cleaned, and replaced.

Task performances. The following performances were recorded over four trials.

1. Grasps and holds first presented object.
2. Takes first presented object to the mouth.
3. Transfers the first object to the opposite hand when presented with the second object.
4. Transfers the first object to the opposite hand in anticipation of (prior to presentation of) the second object.

5. Takes the second object at the midline.
6. Deposits an object when presented with a third object.
7. Leaves a deposited object in storage until end of trial.
8. Uses another person to store objects (i.e. Mother, attendant, experimenter).
9. Total number of objects taken per trial.

Definition of skills. Of the performances listed above, the following skills were considered for comparison with the stages of object permanence.

Simple reach and grasp: The first object is taken and held, (performance 1).

Hand to hand transfer: a shift of the first object from one hand to the other in order to take the second object (performance 3 or 4).

Deposit: distinguished from dropping the object or otherwise 'abandoning' it. 'Placing' an object in the lap, crook of the arm, or elsewhere in order to free a hand to take another object. The period of deposit may be very short. A deposited object may be immediately retrieved with no subsequent attempt to take the third object being presented. The performance or gesture to free the hand for the third object is what counts as deposit, even if the new object is never taken (performance 6).

Storage: permanent deposit, i.e., deposit until the end of trial (performance 7 or 8).

Procedure

All subjects were tested at a time convenient and conducive to them, either in the morning after breakfast and before nap-time, or in the afternoon, after lunch and nap. Subjects tested at home were given both tasks while seated in their Mother's lap at the kitchen table. Most subjects tested at day care centers were seated in the attendant's lap. Some of the oldest subjects tested at day care centers were seated alone at a table opposite the experimenter.

Care was taken to insure that brothers, sisters, fathers, playmates, or other interested individuals, were not present to distract the subjects. Mothers and attendants were requested not to speak to the experimenter, or to 'coach' the subjects while the tasks were being administered.

Each infant received both tasks at one sitting. Each was administered first, the object possession task, and second, the object permanence task. This order of presentation was particularly effective, but, moreover, was deemed necessary owing to extreme difficulties encountered during pilot work, when the opposite order of presentation was attempted.

The tasks were administered one right after the other. Immediately subsequent to completion of the object possession task, (while the infant was playing with the aluminum foil balls he had taken during the fourth trial),

the apparatus was set up on the table before him, and he was presented with the first object for the object permanence task.

With the youngest infants (aged 4-9 mns.) one of the aluminum foil balls they were handling was used for the first item of the 'Piaget Series', (visual accommodation). This first item was not administered to infants older than 9 months of age. Otherwise, the 'Piaget Series' was administered to all infants in the order previously listed. If and when an infant failed to pass an item, he was subsequently presented with the next two items in the sequence.

Administration of both tasks required from five to ten minutes for the youngest infants (aged 4-9 mns.). The rest of the infants took about twenty minutes to complete both tasks.

Performance items for both tasks were listed on pre-typed data sheets, which appear in the Appendix. Successful performances were checked-off by the experimenter during the session.

Results

Before proceeding to the major results it should be noted that no sex, or situation (home vs. day care center) differences were evidenced in the data of the present research. The data reported below are grouped in the following way: (a) Bruner's skills; (b) Piaget's stages, and the items of the 'Piaget Series'; (c) the relationships between Bruner's skills and Piaget's stages.

Bruner's Skills

The sequential emergence of Bruner's skills was tested according to the method described by Brainerd (1971). All subjects were first classified in terms of whether or not they performed each of the four skills: (a) reach and grasp; (b) hand to hand shift; (c) deposit; and (d) storage. The performance criterion was the exhibition of each particular skill at least once in four trials (the same criterion Bruner used when reporting the later skills: deposit and storage). These data were then entered in a four-fold contingency table for significance testing.

If Bruner's skills, as listed, actually occur in an invariant sequence, then the proportion of subjects who perform a particular skill (e.g. hand to hand shift), but do not perform the next skill (e.g. deposit), should be significantly greater than the reverse (i.e., those who

perform deposit, but do not perform hand to hand shift). The differences between these proportions for all skills were tested for significance by use of the following formula (Siegel, 1956):

$$P(x) = \binom{n}{x} P^x Q^{n-x}$$

where P = the proportion of subjects expected to perform a particular skill, but not to perform the next,
(.5)

$Q = 1-P$ = the proportion of subjects expected to perform the reverse, (.5)

x = the cell with the largest number of subjects

n = the other cell

$$\binom{n}{x} = \frac{n!}{x! (n-x)!}$$

This formula gives the exact probability associated with the proportional differences described. A significant difference is evidenced for each skill X skill comparison, as shown in Table 1. Every subject but one, performed the skills in sequence. In Table 1, the tetrad which relates hand to hand shift to deposit shows that one subject performed deposit, without first performing hand to hand shift. This particular discrepancy does not undermine the invariance of the sequence of skills as performed, but it does reflect an inconsistency, in terms of task requirements, which receives some discussion in the next section.

Table 1
The Relationships Between
Bruner's Four Skills

BRUNER'S SKILLS	Reach and Grasp		Hand To Hand Shift		Deposit		Storage	
	+	o	+	o	+	o	+	o
Reach and Grasp	+			11		19		25
	o		0		0		0	
Hand To Hand Shift	+					8 [*]		13
	o				1		0	
Deposit	+							6 [*]
	o						0	
Storage	+							
	o							

+ = present

o = absent

* $p < .025$

Piaget's Stages, and Items of the 'Piaget Series'

Brainerd's method was also used to evaluate the stages described by Piaget. The performance criterion in this case was passing either or both of the two items representative of each of the four stages: (III) extension of accommodation; (IV) active search; (V) visible displacements; and (VI) invisible displacements. All differences were significant, as shown in Table 2.

Because Decarie's 'Piaget Series' was altered to conform to the apparatus constructed for this experiment, certain procedural differences were inevitable. In order to insure that procedural differences did not disrupt the proposed sequence of the original 'Piaget Series', and in order to determine if the apparatus was generally an appropriate means for assessing the development of object permanence, the items of the 'Piaget Series' as administered in this experiment were tested for invariance. The results appear in Table 3. All differences reported in Table 3 are significant, except between items 1 and 2. The lack of discriminability between items 1 and 2 is due to the small number of very young subjects in the present sample. It is noted however that no subject who failed a particular item, was able to pass a later item in the sequence.

Table 2
The Relationships Between
Piaget's Four Stages

PIAGET'S STAGES	III		IV		V		VI	
	+	o	+	o	+	o	+	o
III	+			7		19		32
	o		0		0		0	
IV	+					19		32
	o				0		0	
V	+							32
	o						0	
VI	+							
	o							

+ = present

o = absent

Table 3
The Relationships Between
the Items of the 'Piaget Series'

PIAGET SERIES ITEMS	1		2		3		4		5		6		7		8	
	+	o	+	o	+	o	+	o	+	o	+	o	+	o	+	o
1	+			*5		7		14		19		28		32		36
	o		0		0		0		0		0		0		0	
2	+					7		14		19		28		32		36
	o				0		0		0		0		0		0	
3	+							14		19		28		32		36
	o						0		0		0		0		0	
4	+									19		28		32		36
	o								0		0		0		0	
5	+											28		32		36
	o										0		0		0	
6	+													32		36
	o												0		0	
7	+															36
	o														0	
8	+															
	o															

+ = present

o = absent

* $p > .05$

The Relationships Between Bruner's Skills and Piaget's Stages

It has been established that Bruner's skills (as measured here) emerge in an invariant sequence. The order of emergence of Piaget's stages has also been confirmed. The concern now is to determine the developmental relationships between Bruner's skills and Piaget's stages. In order to conduct this analysis, all subjects were classified in terms of whether or not they performed each of the skills and stages presented in Table 4. The performance criteria were the same as previously given: (a) exhibiting the particular skill at least once in four trials; and (b) passing either or both items of the 'Piaget Series' representative of the particular stage. These data were entered in a table consisting of 16 tetrads which displayed all of the relationships between the skills in sequence, and the stages in sequence, (Table 5, below). The differences of relevance here, appear along the right-left diagonal within each tetrad. These differences concern the proportion of subjects who exhibit a particular skill (e.g. deposit), but fail a particular stage (e.g. visible displacements), versus the proportion of subjects who do not exhibit the particular skill (in this case deposit), but pass the particular stage (i.e., visible displacements). The greater the difference between these proportions for each skill and stage, the less likely a correspondence exists between the particular skill and the

Table 4
Bruner's Sequence of Skills and
Piaget's Sequence of Stages

Reach and Grasp	III Extension of Accommodation
Hand to Hand Shift	IV Active Search
Deposit	V Visible Displacements
Storage	VI Invisible Displacements

Table 5
The Relationships Between
Bruner's Skills and Piaget's Stages

BRUNER'S SKILLS	PIAGET'S STAGES								
	III		IV		V		VI		
	+	o	+	o	+	o	+	o	
Reach and Grasp	+	40	0	33	7	21	19	8	32
	o	0	0	0	0	0	0	0	0
Hand To Hand Shift	+	29	0	28	1	21	8	8	21
	o	11	0	5	6	0	11	0	11
Deposit	+	21	0	20	1	20	1	8	13
	o	19	0	13	6	1	18	0	19
Storage	+	15	0	15	0	15	0	7	8
	o	25	0	18	7	6	19	1	24

Note.—P-values are listed in order for each column of tetrads.

+ = present

o = absent

0.0	7.81×10^{-3}	1.91×10^{-6}	2.34×10^{-9}
4.88×10^{-4}	0.094	3.91×10^{-3}	4.78×10^{-7}
1.91×10^{-6}	8.55×10^{-4}	0.25	1.22×10^{-4}
2.98×10^{-8}	3.84×10^{-6}	0.016	0.018

particular stage. The formula presented earlier was used to test the difference between the relevant proportions for all 16 tetrads.

The tetrads of interest fall along the left-right diagonal of Table 5. These tetrads display the relationships between each particular skill in Bruner's sequence and the corresponding stage of Piaget's sequence. A ceiling effect is evidenced in the first tetrad which relates reach and grasp with stage III (extension of accommodation). Synchrony is indicated between hand to hand shift and stage IV (active search), and between deposit and stage V (visible displacements)--where no significant performance differences are evidenced. All other tetrads display significant performance differences, including the bottom, right tetrad which relates the last skill (storage) with stage VI of object permanence (invisible displacements). This tetrad indicates that, among the subjects who passed the last stage of object permanence, only one was not able to store; while, among the subjects able to store, eight were not able to pass the last stage. The tetrad which relates storage to stage V (immediately to the left of the tetrad just discussed), indicates that while six subjects passed stage V (visible displacements) without being able to store, no subject who stored was unable to pass stage V. With respect to a possible relationship between storing objects, and object permanence, the two tetrads discussed

above show that storage occurs between stage V and stage VI of object permanence. It appears that the ability to store comes after the ability to take into account visible displacements of an object. But, the ability to store comes before acquisition of the concept of object permanence.

Table 5 presents a total picture. All relationships between the skills and stages have been displayed, and all relevant differences reported. However, most of the relationships and differences are of little or no consequence in the present context. It has already been established that the skills and stages occur in sequence and that they are performed by subjects of an approximately coincident age range. It is therefore not surprising, nor of particular interest, that performance differences between later skills and earlier stages, and vice versa, are highly significant.

Discussion

This study was initiated in order to evaluate the sequential emergence of Bruner's skills, and Piaget's stages; and, to explore the relationship between storing objects and object permanence. Before discussing the results which pertain to these questions, some discussion is given concerning the methods of the present experiment, on which the results depend.

The Materials

The findings of this study were influenced by the materials used. The aluminum foil balls, graded in size, forced performance of deposit and storage in the object possession task. These relatively light and easy to grasp objects probably also influenced performance, by the very young subjects, of reach and grasp. Whereas Bruner's objects were sufficiently small to be grasped two at a time by subjects with large hands, they may also have been large enough and sufficiently cumbersome to preclude grasping by the youngest infants with relatively small hands. It will be recalled that some of Bruner's youngest subjects were unable to maintain control of the object once it was grasped; and, two subjects were never able to grasp the objects at all. The ceiling effect evidenced in the performance of reach and grasp displayed in Table 1 and

Table 5 of the previous section was likely contributed to by the fact that the smallest objects used in the present study (circumference 4"), although large to the extent that only one could be taken per hand, were yet small enough to be grasped by all of the youngest infants.

Use of the apparatus described in the method section gave results identical to the earlier findings of Decarie (1965). This was encouraging and not necessarily expected. Although Gratch and Landers (1967) constructed their own apparatus for testing stage III and stage IV behavior--with which they confirmed Piaget's proposed sequence--most studies have employed pillows and placemats, etc., as previously mentioned. Horizontal covers may be deformed by the objects hidden under them, providing visual cues as to the place of the object. Unlike horizontal covers, the vertical screens of the apparatus used in the present experiment hide the objects completely, with no protuberances. Further, with horizontal covers, the pillows, placemats, etc., are lifted-up by the experimenter when hiding the objects. Except in item 2 (reconstruction of a whole from a visible part), the vertical screens of the present apparatus are never touched by the experimenter when hiding the objects. The objects are simply passed behind the screens and deposited. These differences introduced by use of vertical screens could likely have influenced performance on the 'Piaget Series' in the direction of making the total task

more difficult.

The objects used in the 'Piaget Series' (excluding the 'plastic thing' which defies description) were rather 'ordinary' objects. Yet, they were sufficiently stimulating to sustain attention. It must be noted that these objects did not provide inordinant cues such as the bells used by Uzgiris and Hunt (1966), or the raisins and marshmallows employed by Escalona and Corman (1967).

Administration of the Tasks

The two main problems the experimenter inevitably confronts when working with infants are attention and fear. Besides the fact that the objects used in the present experiment appeared sufficiently stimulating, administration of the 'Piaget Series' by use of the apparatus constructed for this experiment took much less time than that required to administer the other two tests. This undoubtedly curtailed the boredom, fatigue and frustration factors pointed out by Miller, Cohen and Hill (1970).

Of the two problems mentioned, fear may be more important than attention. Most all infant studies employ a fear criterion--often vague--on the basis of which subjects may be excluded from the sample. Subjects who made no attempt to take the first object in the Bruner and Lyons (1969) study were not included in the sample. In the Miller, Cohen and Hill (1970) study, subjects who cried, or otherwise

showed distress when presented with a task item, were similarly 'cut'. With plenty of resources (subjects, time, money) the sampling procedure described above may be the best. However, the conditions in which the present experiment was undertaken did not permit such treatment. The subjects were few and far between. There was no time to 'waste' subjects, and little time to spend getting acquainted with subjects. Under these conditions, presenting the object possession task first, and the 'Piaget Series' second, proved remarkably effective. With the object possession task, the experimenter gives objects to the child for him to 'play' with. Four trials of giving and playing serve to establish a congenial and workable relationship between the child and the 'strange' experimenter. Such a relationship, if not necessary, is certainly helpful when administering the inherently frustrating 'Piaget Series' which consists in hiding objects, or taking them away.

Bruner's Skills

Bruner's step like process of cognitive development was supported. Results of the present study showed that the skills Bruner reported invariably occur in the sequence he proposed. The following two factors give perspective to this finding: (a) except hand to hand shift, the skills, by definition, presuppose the order of occurrence proposed by Bruner; (b) whereas the experimental conditions of the

Bruner and Lyons (1969) study did not necessitate exhibition of any of the skills except reach and grasp, conditions in the present experiment made necessary the performance of all skills except hand to hand shift.

The skills, as defined, inherently prescribe an order of occurrence. Storage presupposes deposit which presupposes reach and grasp. An infant must take an object before he can deposit it; and, he must deposit an object before he can store it. Hand to hand shift presupposes reach and grasp and hence must follow reach and grasp. Yet hand to hand shift need not precede deposit and storage. An infant could reach for and grasp the first object, deposit it, and leave it in storage. He could then take the second object, perform hand to hand shift, and take the third. But the initial requirement imposed when the second object is immediately presented to the hand which took the first, increases the likelihood that if hand to hand shift is exhibited at all, it will come second in the sequence. All infants in the present sample who exhibited hand to hand shift, performed it second in the sequence.

Although the skills inherently prescribe a sequence, the experimental conditions in the Bruner and Lyons study did not actually require the infants to perform the skills. The skills were sufficient for successful task performance, but not necessary. Infants with large hands, who waited 15-20 secs. after presentation of the second object, could

take possession of all four objects simply by reaching for and grasping each object as it was presented to them. In Bruner's study, infants with large hands, who took the second object at the midline, didn't have to perform hand to hand shift, deposit, or storage.

The present study was particularly concerned with a possible relationship between storing objects and object permanence. It was therefore important that infants exhibit deposit and storage. Objects graded in size (the only change in an otherwise careful replication of the Bruner and Lyon's experiment) were used to insure that no infant could take more than one object in each hand, and thus circumvent deposit and storage. Forcing the performance of these skills likely inflated the distribution of scores in the deposit and storage categories, with the result that significant differences were evidenced between all skills of the present study, where they may not have been present in the Bruner and Lyon's study. But, though successful performance of the task was made contingent upon exhibiting deposit and storage in the present study, no measures could be taken to insure that infants would necessarily perform hand to hand shift. Nevertheless, as reported in the results, only one infant performed a later skill (deposit) without first performing hand to hand shift.

Piaget's Stages, and the Items of the 'Piaget Series'

Results of this study confirmed the sequence of stages proposed by Piaget. No research has yet been reported which contradicts the stage by stage sequence proposed by Piaget. For this reason, barring extreme differences which could have resulted from use of the apparatus constructed for the present experiment, confirmation of Piaget's stage by stage sequence was certainly expected.

Perhaps the most significant recently reported research concerning object permanence is the study by Miller, Cohen and Hill (1970). Order effects were the focus of their study which included a replication condition (of the Uzgiris and Hunt measure) and an extension condition (where task items were presented out of order). The most important finding of the Miller, Cohen and Hill study was a within-stage difference concerning stage V. They found that the ability to find an object which is placed out of sight inside a container and then hidden under a single cover (item 6 of the 'Piaget Series'), occurs before the ability to find an object which is visibly hidden under a cover, and then visibly displaced under another cover (item 5 of the 'Piaget Series'). The Miller, Cohen and Hill results are contrary to findings of the present study where all subjects performed all items of the 'Piaget Series' in sequence (Table 3). But, their findings do not bear on the major results of the present study, since the criterion used here

for stage X stage and stage X skill comparisons was passing either or both items representative of a particular stage.

The Miller, Cohen and Hill study has little significance in the present context, but it is of general importance because the stage discrepancy is the first reported contradiction of the earlier findings of Decarie (1965), Uzgiris and Hunt (1966) and Escalona and Corman (1967) all of which confirmed the within-stage sequence originally proposed by Piaget (1952, 1954). Of further interest is the fact that the stage V discrepancy showed-up in both conditions of the Miller, Cohen and Hill study, and was not made evident by virtue of procedures employed to control for order effects. Results of the replication condition and the extension condition "were generally similar" (Miller, Cohen and Hill, 1970, p. 79).

Object Possession and Object Permanence

Successful performance of the object possession task depends on the ability to store objects. Successful performance of the 'Piaget Series' depends on the recognition that objects have permanent existence independent of vision, and independent of changes in position.

It will be recalled that a stage V infant can find an object which undergoes a change in position, so long as he can see it. He can also find an object which has been invisibly hidden, so long as it doesn't undergo a change in

position. But if an object is both invisibly hidden, and displaced, the stage V infant 'gropes'. This experimenter noticed a definite similarity between the 'groping' of infants presented with an invisible displacement, and the hesitancy of infants who deposited an object, but retrieved it and wouldn't store. To store an object, the infant must deposit (displace) the object, and he must turn away from it (let the object pass out of sight, if only momentarily), if he is to take the new object being presented.

Apparently, the infant who deposits but doesn't store, does not recognize that an object retains its permanence independent of both vision and displacement. The results showed that the greatest synchrony between any skill and stage occurred between deposit and stage V. These results confirm the first hypothesis of the present study: infants who deposit but do not store, have not acquired the concept of object permanence.

The results also showed that storage occurred after stage V and before stage VI. Because storage requires both displacement of an object, and letting an object pass out of sight, it should be expected that storage would follow stage V. Also, since the invisible displacements of stage VI presuppose and encompass the vision and displacement aspects of storage it is reasonable that storage precedes if not overlaps stage VI. Of the sequence of Bruner's skills evaluated in this study, storage and

deposit--though distinct--are the most closely linked. Unlike the other skills, which are distinguished largely by differences in overt behavior, what separates storage from deposit is in Bruner's estimate, the mastery of delay. The capacity for delay develops slowly. And, as Bruner mentioned, the conflict involved with storing an object is not easily resolved. For these reasons, the fact that an infant exhibits storage on his best trial (that is, at least once in four trials, as Bruner reported his data) may not indicate that he has completely resolved the conflict, particularly if on the other trials he retrieved the object without leaving it in storage. Although Bruner's concern was only to show that taking possession of objects depends on the development of a sequence of skills, the purpose of the present study was to consider storage in the context of object permanence. For this purpose, Bruner's minimal criterion was not sufficiently clear, because it was necessary to know if storage is reliably performed without any hesitancy or conflict.

In the present study, all infants who performed storage routinely, (stored objects on all four trials), passed the last stage of object permanence. And of the five subjects who passed the last stage, four of these completed the last item of the 'Piaget Series' (systematic use of representation), indicating they had acquired the concept of object permanence. Although these findings are not

subject to statistical test, they serve to support the second hypothesis of the present study: infants who routinely store objects have acquired the concept of object permanence.

Conclusion and Suggestions for Further Study

The present study confirmed Bruner's proposed step like process of cognitive development, and showed a relationship between storing objects and object permanence. Although Bruner's characterization of infant development is not as complete or explicit as that of Piaget, the fact that Bruner has discovered an invariant sequence of acquisitions which occur during the same period as Piaget's sensorimotor stages should warrant further investigation.

The present study showed that the performance of storage was a necessary precondition for the acquisition of object permanence. Further examination of Bruner skills in the context of Piaget might reveal other performance-competence relationships.

Perhaps as important as the experimental findings of the present study, is the apparent efficacy of the apparatus used to administer the 'Piaget Series'. But, though the procedure for administering the tasks with the apparatus of this experiment seemed operationally clear, it may not have precluded experimenter bias.

Further investigation of the relationships between Bruner's skills and Piaget's stages, as determined by use

of the materials described in this study, should probably be undertaken. A sufficient sample of subjects, including more young subjects should be procured before hand, and not haphazardly, as in the present study. Further, two or more judges should be present when administering the tasks.

References

- Bell, S.M.V. The relationship of infant-mother attachment to the development of the concept of object-permanence. (Doctoral dissertation, The Johns Hopkins University) Ann Arbor, Mich.: University Microfilms, 1968. No. 69-8666.
- Brainerd, C.J. The development of the proportionality scheme in children and adolescents. Developmental Psychology, 1971, 5, 469-476.
- Bruner, J.S. Processes of growth in infancy. In A. Ambrose (Ed.) Stimulation in early infancy. New York: Academic Press, 1969. Pp. 205-228.
- Bruner, J.S. Origins of problem solving strategies in skill acquisition. Paper presented at the XIXth International Congress of Psychology, London, July, 1969.
- Bruner, J.S., Goodnow, J.J., & Austin, G.A. A study of thinking. New York: Wiley, 1956.
- Bruner, J.S., & Lyons, K. The growth of human manual intelligence. I. Taking possession of objects. 1968. (Mimeographed.)
- Bruner, J.S., Olver, R.R., & Greenfield, P.M. Studies in cognitive growth. New York: Wiley, 1966.
- Corman, H.H., & Escalona, S.K. Stages of sensorimotor development: a replication study. Merrill-Palmer Quarterly of Behavior and Development, 1969, 15, 351-361.
- Decarie, T.G. Intelligence and affectivity in early childhood. New York: International Universities Press, 1965.
- Elkind, D. Giant in the nursery-Jean Piaget. The New York Times Magazine, May, 1969.
- Escalona, S.K. & Corman, H.H. Albert Einstein scales of sensori-motor development. Department of Psychiatry, Albert Einstein School of Medicine, 1967.

- Gratch, G., & Landers, W.F. A partial replication of Piaget's study of infants' object concepts. Paper presented at the meeting of The Society for Research in Child Development, New York, March, 1967.
- Miller, D.J., Cohen, L.B., & Hill, K.T. A methodological investigation of Piaget's theory of object concept development in the sensory-motor period. Journal of Experimental Child Psychology, 1970, 9, 59-85.
- Piaget, J. The origins of intelligence in children. New York: International Universities Press, 1952.
- Piaget, J. The construction of reality in the child. New York: Basic Books, 1954.
- Pinard, A., & Laurendeau, M. "Stage" in Piaget's cognitive-development theory: Exegesis of a concept. In D. Elkind and J.H. Flavell (Eds.), Studies in cognitive development: Essays in honor of Jean Piaget. New York: Oxford University Press, 1969. Pp. 121-170.
- Siegel, S. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill, 1956.
- Uzgiris, I. Ordinality in the development of schemas for relating to objects. In J. Hellmuth (Ed.) Exceptional infant. Vol. 1. The normal infant. New York: Brunner/Mazel, 1967. Pp. 315-334.
- Uzgiris, I.C., & Hunt, J. McV. An instrument for assessing infant psychological development. Progress report of work supported by U.S. Public Health Service Grant 5-K6-MH-18,567 (Hunt), MH-07347, and MH-08468. February, 1966.
- White, B.L. Human infants: experience and psychological development. Englewood Cliffs, N.J.: Prentice-Hall, 1971.

Appendix

Object Possession Task

Name _____

Score Sheet

Birthday _____ Sex _____

Date _____ Time _____

Performance Items	Trials				Score
1. Grasps and holds first presented object					
2. Takes first presented object to the mouth					
3. Transfers the first object to the opposite hand when presented with the second object					
4. Transfers the first object to the opposite hand in anticipation of the second object					
5. Takes the second object at the midline					
6. Deposits an object when presented with a third object					
7. Leaves a deposited object in storage until end of trial					
8. Uses another person to store objects (i.e., Mother, attendant, experimenter)					
9. Total number of objects taken per trial					

Appendix (continued):

'Piaget Series'

Name _____

Score Sheet

Birthday _____ Sex _____

Date _____ Time _____

Performance Items	Trials			Score
1. Visual accommodation				
2. Reconstruction of a whole from a visible part				
3. Active search with grasping move				
4. Without sequence of visible displacements				
5. With sequence of visible displacements				
6. Without sequence of invisible displacements				
7. With sequence of invisible displacements				
8. Systematic use of representation				

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